PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 28 May 2001 (28.05.01)	
International application No. PCT/FI00/00848	**Applicant's or agent's file reference** BP100395
International filing date (day/month/year) 02 October 2000 (02.10.00)	**Priority date** (day/month/year) 01 October 1999 (01.10.99)
Applicant PIHLAJA, Juha	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

25 April 2001 (25.04.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer J. Leitao
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING SUBMISSION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

Date of mailing (day/month/year) 11 December 2000 (11.12.00)	
Applicant's or agent's file reference BP100395	**IMPORTANT NOTIFICATION**
International application No. PCT/FI00/00848	International filing date (day/month/year) 02 October 2000 (02.10.00)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 01 October 1999 (01.10.99)
Applicant NOKIA OYJ et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.

3. An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

4. The **letters "NR"** appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
01 Octo 1999 (01.10.99)	19992125	FI	05 Dece 2000 (05.12.00)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

S. Mandallaz

Telephone No. (41-22) 338.83.38

Copy for the Elected Office (EO/US)

PCT/FI00/00848

P[illegible]NT COOPERATION TREA[illegible]

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

Date of mailing (day/month/year)
18 December 2001 (18.12.01)

Applicant's or agent's file reference
BP100395

IMPORTANT NOTIFICATION

International application No.
PCT/FI00/00848

International filing date (day/month/year)
02 October 2000 (02.10.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
NOKIA OYJ
Nokia-talo
Keilalahdentie 4
FIN-02150 Espoo
Finland

State of Nationality: FI
State of Residence: FI
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [X] the address [ ] the nationality [ ] the residence

Name and Address
NOKIA CORPORATION
Keilalahdentie 4
FIN-02150 Espoo
Finland

State of Nationality: FI
State of Residence: FI
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
François BAECHLER

Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

004546165

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

Date of mailing (day/month/year) 18 December 2001 (18.12.01)	
Applicant's or agent's file reference BP100395	**IMPORTANT NOTIFICATION**
International application No. PCT/FI00/00848	**International filing date** (day/month/year) 02 October 2000 (02.10.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address	State of Nationality	State of Residence
NOKIA OYJ Nokia-talo Keilalahdentie 4 FIN-02150 Espoo Finland	FI	FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [X] the address [ ] the nationality [ ] the residence

Name and Address	State of Nationality	State of Residence
NOKIA CORPORATION Keilalahdentie 4 FIN-02150 Espoo Finland	FI	FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer François BAECHLER
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:
BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

Berggren Oy Ab
20-04-2001

Date of mailing (day/month/year) 12 April 2001 (12.04.01)	
Applicant's or agent's file reference BP100395	IMPORTANT NOTICE

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/FI00/00848	02 October 2000 (02.10.00)	01 October 1999 (01.10.99)

Applicant
NOKIA OYJ et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,KP,KR,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   AE,AG,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,BZ,CA,CH,CN,CR,CU,CZ,DE,DK,DM,DZ,EA,EE,EP,ES,
   FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,
   MN,MW,MX,MZ,NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,
   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   12 April 2001 (12.04.01) under No. WO 01/26253

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer
J. Zahra

Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Berggren Oy Ab
P.O. Box 16
FIN-00101 HELSINKI
Finland

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of mailing *(day/month/year)*	11-09-2001
Applicant's or agent's file reference: BP100395/SKU/PKK	**REPLY DUE** within 60 days from the above date of mailing: 10/11-01

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI00/00848	02.10.2000	01.10.1999

International Patent Classification (IPC) or both national classification and IPC7
H 04 B 7/26

Applicant
NOKIA OYJ ET AL

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☒ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☒ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application
3. The applicant is hereby **invited to reply** to this opinion.
   - **When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).
   - **How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.
   - **Also** For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4*bis*. For an informal communication with the examiner, see Rule 66.6.

   If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 01.02.2002

Name and mailing address of the IPEA/SE
Patent- och registreringsverket
Box 5055
S-102 42 STOCKHOLM
Telex 17978 PATOREG-S
Facsimile No. 08-667 72 88

Authorized officer
Peder Gjervaldsaeter/AE
Telephone No. 08-782 25 00

WRITTEN OPINION

[redacted]tional application No.
PCT/FI00/00848

I. Basis of the opinion

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".*

WR[redacted] OPINION

[redacted]tional application No.
PCT/FI00/00848

IV. Lack of unity of invention

1. In response to the invitation (Form PCT/IPEA/405) to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. This Authority found that the requirement of unity of invention is not complied with for the following reasons and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

Invention I: Claims 1-3 and 6-7 relates to half- and full-duplex signalling
Invention II: Claims 4 and 5 relates to classifying terminals based on an equipment identifier

3. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this opinion:

- ☒ all parts.
- ☐ the parts relating to claims Nos. _____

WRITTEN OPINION

International application No.
PCT/FI00/00848

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-7	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	1-7	NO
Industrial applicability (IA)	Claims	1-7	YES
	Claims		NO

2. Citations and explanations

The claimed invention relates to a point-to-multipoint radio system, in which the access points operate in full-duplex mode and terminals operate in half-duplex mode. According to the invention, the terminals are grouped into two groups. A first of the two groups is arranged to listen during a first half of a time period and a second of the two groups is arranged to listen during the second half of the time period. The broadcast messages are sent twice, once during said first half of the time period and once during said second half of the time period. All terminals are thus able to receive the broadcast messages, and half of the terminals are able to transmit at the time when the other half is receiving a broadcast message.

In the International Search Report the following documents were cited:
D1: US 5 617 412
D2: WO 9 926 437
D3: US 3 979 723
D4: US 5 506 837
D5: US 5 327 580

D1 describes a half-duplex frequency division multiple access radio system. According to D1, the mobile stations are divided into groups. The mobile stations that belongs to a group have a first frequency for the up link direction and a common second frequency for the down link direction. Only one mobile station of a group can send at a time. In this half-duplex system, a mobile station can not send and receive simultaneously but a base station can simultaneously send to some mobile stations and receive from other mobile stations. (See column 3, line 12-16 and column 6, line16-18.)

Documents D2-D5 fail to describe the claimed invention.

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box V

From D1 is already known a system, in which mobile stations are divided into two groups. The mobile station can either send or receive at a time but the base station can simultaneously send and receive. Only one mobile station in a group can send at a time. All the mobile stations belonging to a group have the same common frequency for down link transmission. D1 also shows the possibility to divide a control frame into two data units, addressing the first data unit to one mobile station and addressing the second data unit to all other mobile stations. By doing this one mobile station first listens to the first data unit and then all the other mobile stations listen to the second data unit. (See column 8, line 11-19.) It is not clearly stated in D1 that all mobile stations in one of the groups are listening for down link information at the same time period that one mobile station in the other group transmits. But since all mobile stations in a group have a common down link broadcast frequency in D1, it is considered obvious for a person skilled in the art to broadcast down link information to one whole group at a time. A broadcast message must then be broadcasted twice, once to each group during the first and second half of the frame, in order to reach all mobile stations. Consequently, if a whole group listens for down link information then one mobile station in the other group can send at that same time period. Therefore, what is claimed in claims 1-3 and 6-7 is not considered to involve an inventive step.

Claims 4 and 5 fail to describe the half- and full-duplex signalling in the system and only states that terminals are classified to belong to a group based on an identifier. In D1 the mobile stations belonging to a group all listen to the same broadcast frequency. This broadcast frequency can be seen an identifier for the mobile stations in a group. Thus, the mobile stations in D1 have a group identifier and it is considered obvious for a person skilled in the art that also other group identifiers can be used, such as the equipment identifier. What is claimed in claims 4 and 5 is therefore not considered to involve an inventive step.

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date *(day/month/year)*	Filing date *(day/month/year)*	Priority date (valid claim) *(day/month/year)*
WO 0054434	14.09.2000	06.03.2000	05.03.1999

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure *(day/month/year)*	Date of written disclosure referring to non-written disclosure *(day/month/year)*

PCT REQUEST BP100395

Original (for **SUBMISSION**) - printed on 02.10.2000 10:07:32 AM

0 0-1	**For receiving Office use only** International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4 0-4-1	**Form - PCT/RO/101 PCT Request** Prepared using	PCT-EASY Version 2.91 (updated 01.07.2000)
0-5	**Petition** The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	**Receiving Office (specified by the applicant)**	National Board of Patents and Registration (Finland) (RO/FI)
0-7	**Applicant's or agent's file reference**	BP100395
I	**Title of Invention**	A RADIO LINK SYSTEM
II II-1 II-2 II-4 II-5 II-6 II-7	**Applicant** This person is: Applicant for Name Address: State of nationality State of residence	 applicant only all designated States except US NOKIA OYJ Nokia-talo Keilalahdentie 4 FIN-02150 Espoo Finland FI FI
III-1 III-1-1 III-1-2 III-1-4 III-1-5 III-1-6 III-1-7	**Applicant and/or inventor** This person is: Applicant for Name (LAST, First) Address: State of nationality State of residence	 applicant and inventor US only PIHLAJA, Juha Latvatie 11 H FIN-02710 Espoo Finland FI FI

PCT REQUEST BP100395

Original (for SUBMISSION) - printed on 02.10.2000 10:07:32 AM

IV-1	**Agent or common representative; or address for correspondence** The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	BERGGREN OY AB
IV-1-2	Address:	P.O. Box 16 FIN-00101 Helsinki Finland
IV-1-3	Telephone No.	+358-9-693701
IV-1-4	Facsimile No.	+358-9-6933944
IV-1-5	e-mail	email.box@berggren.fi
V	**Designation of States**	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH&LI CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW

PCT REQUEST BP100395

Original (for **SUBMISSION**) - printed on 02.10.2000 10:07:32 AM

V-5	**Precautionary Designation Statement** In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	**Exclusion(s) from precautionary designations**	NONE	
VI-1	**Priority claim of earlier national application**		
VI-1-1	Filing date	01 October 1999 (01.10.1999)	
VI-1-2	Number	19992125	
VI-1-3	Country	FI	
VI-2	**Priority document request** The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	**International Searching Authority Chosen**	Swedish Patent Office (ISA/SE)	
VIII	**Check list**	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	11	-
VIII-3	Claims	2	-
VIII-4	Abstract	1	bp100395.txt
VIII-5	Drawings	3	-
VIII-7	TOTAL	21	
	Accompanying Items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-9	Separate signed power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-18	**Figure of the drawings which should accompany the abstract**	2	
VIII-19	**Language of filing of the international application**	English	
IX-1	**Signature of applicant or agent**	Sirpa Kuisma	
IX-1-1	Name	BERGGREN OY AB	
IX-1-2	Name of signatory	Sirpa Kuisma	
IX-1-3	Capacity	Patent Attorney	

PCT REQUEST

BP100395

Original (for SUBMISSION) - printed on 02.10.2000 10:07:32 AM

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	

TENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
BP100395/SKU/PKK		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI00/00848	02.10.2000	01.10.1999
International Patent Classification (IPC) or national classification and IPC7		
H 04 B 7/26		
Applicant		
Nokia Corporation et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☒ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
25.04.2001	02.01.2002
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Peder Gjervaldsaeter/mj Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI00/00848

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

Invention I: Claims 1-3 and 6-7 relates to half- and full-duplex signalling
Invention II: Claims 4 and 5 relates to classifying terminals based on an equipment identifier

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
- ☐ the parts relating to claims Nos. _____

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI00/00848

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-7	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	1-7	NO
Industrial applicability (IA)	Claims	1-7	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention relates to a point-to-multipoint radio system, in which the access points operate in full-duplex mode and terminals operate in half-duplex mode. According to the invention, the terminals are grouped into two groups. A first of the two groups is arranged to listen during a first half of a time period and a second of the two groups is arranged to listen during the second half of the time period. The broadcast messages are sent twice, once during said first half of the time period and once during said second half of the time period. All terminals are thus able to receive the broadcast messages, and half of the terminals are able to transmit at the time when the other half is receiving a broadcast message.

In the International Search Report the following documents were cited:
D1: US 5 617 412
D2: WO 9 926 437
D3: US 3 979 723
D4: US 5 506 837
D5: US 5 327 580

D1 describes a half-duplex frequency division multiple access radio system. According to D1, the mobile stations are divided into groups. The mobile stations that belongs to a group have a first frequency for the up link direction and a common second frequency for the down link direction. Only one mobile station of a group can send at a time. In this half-duplex system, a mobile station can not send and receive simultaneously but a base station can simultaneously send to some mobile stations and receive from other mobile stations. (See column 3, line 12-16 and column 6, line16-18.)

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

Documents D2-D5 fail to describe the claimed invention.

From D1 is already known a system, in which mobile stations are divided into two groups. The mobile station can either send or receive at a time but the base station can simultaneously send and receive. Only one mobile station in a group can send at a time. All the mobile stations belonging to a group have the same common frequency for down link transmission. D1 also shows the possibility to divide a control frame into two data units, addressing the first data unit to one mobile station and addressing the second data unit to all other mobile stations. By doing this one mobile station first listens to the first data unit and then all the other mobile stations listen to the second data unit. (See column 8, line 11-19.) It is not clearly stated in D1 that all mobile stations in one of the groups are listening for down link information at the same time period that one mobile station in the other group transmits. But since all mobile stations in a group have a common down link broadcast frequency in D1, it is considered obvious for a person skilled in the art to broadcast down link information to one whole group at a time. A broadcast message must then be broadcasted twice, once to each group during the first and second half of the frame, in order to reach all mobile stations. Consequently, if a whole group listens for down link information then one mobile station in the other group can send at that same time period. Therefore, what is claimed in claims 1-3 and 6-7 is not considered to involve an inventive step.

Claims 4 and 5 fail to describe the half- and full-duplex signalling in the system and only states that terminals are classified to belong to a group based on an identifier. In D1 the mobile stations belonging to a group all listen to the same broadcast frequency. This broadcast frequency can be seen an identifier for the mobile stations in a group. Thus, the mobile stations in D1 have a group identifier and it is considered obvious for a person skilled in the art that also other group identifiers can be used, such as the equipment identifier. What is claimed in claims 4 and 5 is therefore not considered to involve an inventive step.

What is claimed in claims 1-7 is thus novel and comprises industrial applicability but is not considered to involve an inventive step.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00848

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/26
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5617412 A (MARC DELPRAT ET AL), 1 April 1997 (01.04.97), column 3, line 12 - line 19; column 6, line 4 - line 22; column 8, line 1 - line 19, abstract --	1-7
A	WO 9926437 A1 (ERICSSON INC.), 27 May 1999 (27.05.99), claim 1, abstract --	1-7
A	US 3979723 A (DAVID ROBERT HUGHES ET AL), 7 Sept 1976 (07.09.76), column 3, line 24 - line 50, abstract --	1-7

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 January 2001	23 -01- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Peder Gjervaldsaeter/mj Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00848

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5506837 A (MICHAEL SÖLLNER ET AL), 9 April 1996 (09.04.96), column 1, line 64 - column 2, line 18; column 6, line 61 - column 7, line 9	1-7
	--	
A	US 5327580 A (CLAUDE L. VIGNALI ET AL), 5 July 1994 (05.07.94), column 2, line 32 - column 3, line 4	1-7
	--	
P,A	WO 0054434 A1 (NOKIA NETWORKS OY), 14 Sept 2000 (14.09.00), claims 1,3,9, abstract	1-7
	--	

INTERNATIONAL SEARCH REPORT

Information on patent family members

27/12/00

International application No.
PCT/FI 00/00848

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5617412 A	01/04/97	EP 0677930 A	18/10/95
		FR 2718907 A,B	20/10/95
WO 9926437 A1	27/05/99	AU 1524799 A	07/06/99
		BR 9814965 A	03/10/00
		EP 1031247 A	30/08/00
US 3979723 A	07/09/76	DE 2628753 A,B,C	12/05/77
		FR 2330225 A,B	27/05/77
		GB 1521340 A	16/08/78
		JP 1227758 C	19/09/84
		JP 52055302 A	06/05/77
		JP 59002418 B	18/01/84
US 5506837 A	09/04/96	DE 4304095 A	18/08/94
		EP 0611006 A	17/08/94
		JP 6350519 A	22/12/94
US 5327580 A	05/07/94	NONE	
WO 0054434 A1	14/09/00	FI 4520 U	10/08/00
		FI 990483 A,V	06/09/00

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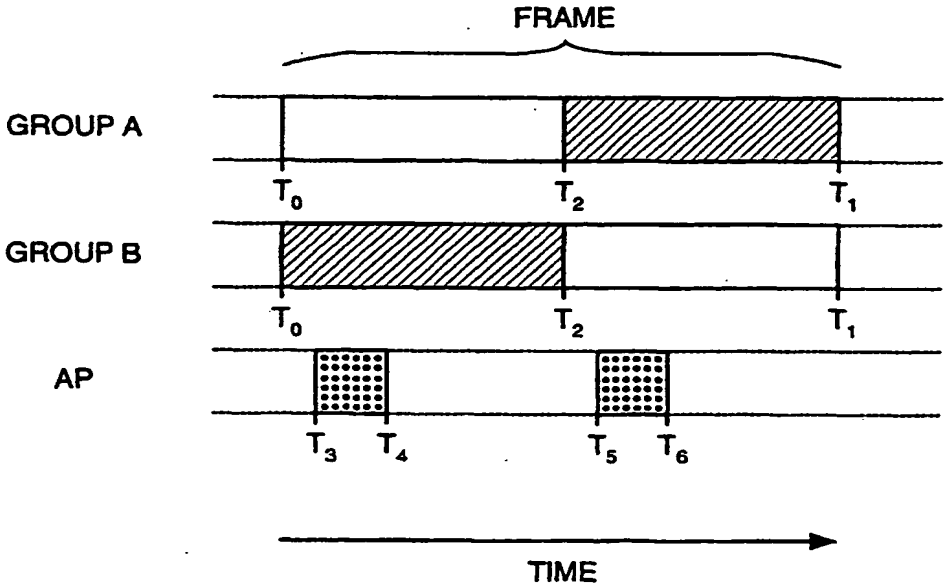
Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A RADIO LINK SYSTEM



(57) Abstract: The invention is directed to microwave radio link systems. The invention concerns point-to-multipoint (PMP) radio systems, in which the access points (AP) operate in full-duplex mode and terminals (Access Terminal, AT) operate in half-duplex mode. According to the invention, the terminals are grouped into two groups. A first group of the two groups is arranged to listen during a first half of a time period and a second group of the two groups is arranged to listen during the second half of the time period. The broadcast messages are sent twice i.e. once during said first half of the time period and once during said second half of the time period, whereby all terminals are able to receive the broadcast messages, and half of the terminals are able to transmit at the time when the other half is receiving a broadcast message.

WO 01/26253 A1

A radio link system

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to microwave radio link systems, especially to such systems as described in the preamble of claim 1.

2. Description of Related Art

The invention concerns point-to-multipoint (PMP) radio systems, in which the access points (AP) operate in full-duplex mode and terminals (Access Terminal, AT) operate in half-duplex mode. Figure 1 illustrates the structure of such a system. Figure 1 shows terminals 10, an access point 20, and a telecommunications network 30. Typically such systems are used to provide fixed wireless connections between a central station i.e. an access point 20 (AP) and several fixed substations i.e. access terminals 10 (AT). Such systems are very advantageous in environments, where provision of fixed lines would cause prohibitive costs, such as in cities. Typically such systems are used to link base stations of a cellular telecommunications network to a central station 20, which is connected to rest of the telecommunications network 30. Such systems are also often used for providing wireless local area networks (WLAN). Such systems are also often used to provide connections between public networks and private business and residential customers.

In many cases such systems use time division to separate signals of the terminals from each other, i.e. they are arranged to transmit at different times. For simplicity and reasons of cost, terminals typically operate in half-duplex mode, i.e. the terminals cannot transmit and receive at the same time. The access points are typically capable of full-duplex operation. The number of access points in a network is considerably lower than the number of terminals, whereby the requirements for low cost are not as stringent as in the case of terminals and the structure of access points can be more complicated.

One example of such a system is the HIPERACCESS and HIPERLAN systems specified by the European Telecommunications Standards Institute. The HIPERACCESS system is described in detail in the ETSI specification

DTR/BRAN-010001 "Broadband Radio Access Networks (BRAN): Requirements and architectures for HIPERACCESS fixed networks".

According to current ETSI Bran Hiperlan/2 (HL2) draft specifications each terminal has to listen to a broadcast message (BM) at regular intervals, once in a constant length frame. Half-duplex terminals cannot send during that time even though the AP is always able to receive, since the AP operates in full duplex mode. Thus the uplink channel is idle during that time and radio interface capacity is wasted.

SUMMARY OF THE INVENTION

An object of the invention is to realize a PMP radio link system, which avoids the problems of prior art. A further object of the invention is to realize a PMP radio link system, which is able to use the capacity of the radio interface better than systems according to prior art.

The objects are reached by arranging the terminals into two groups, arranging a first group of the two groups to listen during a first half of a time period, arranging the second group of the two groups to listen during the second half of the time period, and sending broadcast messages twice i.e. once during said first half of the time period and once during said second half of the time period.

The system according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a system. The access point according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a access point. The terminal according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a terminal. The method according to the invention is characterized by that, which is specified in the characterizing part of the independent method claim. The dependent claims describe further advantageous embodiments of the invention.

According to the invention, the terminals are grouped into two groups. A first group of the two groups is arranged to listen during a first half of a time period and a second group of the two groups is arranged to listen during the second half of the time period. The broadcast messages are sent twice i.e. once during said first half of the time period and once during said second half of the time period, whereby all

terminals are able to receive the broadcast messages, and half of the terminals are able to transmit at the time when the other half is receiving a broadcast message.

The broadcast messages transmitted by the access point comprise various control information, such as for example the identifier of the access point, identifier of the network operator, and identifier of the transmission sector. The broadcast messages may also comprise other types of information such as information about an access time slot, during which new terminals may initiate communication with the access point. The broadcast messages also indicate the reception periods of individual terminals. Consequently, the two broadcast messages have some parts in common, while terminal-specific parts are naturally different in the two broadcast messages of a frame.

Typically, the access point specifies the transmission periods allocated for a terminal in an individual transmission to the terminal, along with other terminal specific control information and possibly payload data. A terminal does not need to receive during other times as the broadcast message times and reception times indicated by the AP. During the other times, a terminal may transmit if transmission is allowed by the AP, or the terminal may be in idle mode in order to save power.

Each terminal advances the granted time values by the double propagation delay given by AP, so that the transmission of the terminal arrives at the access point at the indicated time, and conversely for reception.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail in the following with reference to the accompanying drawings, of which

Figure 1 illustrates a PMP system according to prior art, and

Figure 2 illustrates timing according to an advantageous embodiment of the invention.

Figure 3 illustrates timing according to a further advantageous embodiment of the invention,

Same reference numerals are used for similar entities in the figures.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A. A FIRST GROUP OF ADVANTAGEOUS EMBODIMENTS

In the following, an advantageous embodiment of the invention is described with reference to figure 2. Figure 2 illustrates the timing of listening and transmission times of various parties of a PMP system, i.e. the timing of a first group GROUP A, a second group GROUP B and an access point AP. White rectangles denote listening times, hatched rectangles denote time when a party may transmit and dotted rectangles denote actual transmission. Time T_0 denotes the beginning of a frame and time T_1 denotes the end of that frame and the beginning of the second frame. Time T_2 denotes the middle of the frame. According to the present advantageous embodiment of the invention, terminals in the first group GROUP A listen during the time period T_0 to T_2, and may transmit in the time period T_2 to T_1. Terminals in the second group GROUP B may transmit during the time period T_0 to T_2, and they listen in the time period T_2 to T_1. The access point transmits a broadcast message during the interval between times T_3 and T_4, which are both between times T_0 and T_2. The terminals in the first group GROUP A receive the message during that time, while terminals in the second group GROUP B may transmit during that time. At time T_2, terminals in the second group GROUP B begin to listen, and the access point transmits the second broadcast message during the interval between times T_5 and T_6, which are both between times T_2 and T_1. The terminals in the second group GROUP B receive the message during that time, while terminals in the first group GROUP A may transmit during that time.

In one advantageous embodiment of the invention, the broadcast messages are sent in the beginning of the frame and in the middle of the frame, i.e. times T_0 and T_3 are the same and T_2 and T_5 are the same.

B. A SECOND GROUP OF ADVANTAGEOUS EMBODIMENTS

In the following, a further advantageous embodiment of the invention is described with reference to figure 3. Figure 3 illustrates the timing of listening and transmission times of various parties of a PMP system, i.e. the timing of a first group GROUP A, a second group GROUP B and an access point AP. White rectangles denote listening times, hatched rectangles denote time when a party may transmit and dotted rectangles denote actual transmission. Time T_0 denotes the

beginning of a frame and time T_1 denotes the end of that frame and the beginning of the second frame. The first broadcast message is transmitted during the interval between times T_3 and T_4, and the second broadcast message during the interval between times T_5 and T_6. According to the present advantageous embodiment of the invention, terminals in the first group GROUP A listen during the time period T_3 to T_4, and may transmit during other times. Terminals in the second group GROUP B listen during the time period T_5 and T_6, and may transmit during other times.

In a further advantageous embodiment of the invention, the broadcast messages are sent in the beginning of the frame and in the middle of the frame, i.e. times T_0 and T_3 are the same and T_2 and T_5 are the same.

The two broadcast messages preferably comprise an identifier indicating which of the two broadcast messages a particular broadcast message is. Such an identifier allows terminals to recognize if a particular broadcast message is directed to the group it belongs to or to the other group. The identifier can be for example in the form of a bit pattern in the beginning of the broadcast message.

The allocation of actual transmission turns for the terminals for the time periods when the terminals may transmit can be performed in many ways. One advantageous method for allocating the transmission turns is described later in this specification.

According to an advantageous embodiment of the invention, the grouping of terminals to two groups is performed without any signalling from the access point. The grouping can advantageously be based on a device dependent parameter such as a device serial number or some other equipment identifier, more specifically on the value of the least significant bit of such an identifier. The terminal therefore knows which group it belongs to without any explicit signalling from the access point. This arrangement ensures, that almost any set of terminals can be grouped into two groups of roughly equal size.

According to a further advantageous embodiment of the invention, the access point can instruct one or more terminals to switch groups, if the sizes of the groups are too unequal.

C. A THIRD GROUP OF ADVANTAGEOUS EMBODIMENTS

Access point manages transmission timing of the terminals according to certain rules such that uplink capacity can be in full use. In the following, one example of such rules according to an advantageous embodiment is described.

The access point grants permissions to terminals to send uplink data based on transmission requests it has received from the terminals. The AP calculates and organizes the time slots so that each terminal does not need to receive downlink data and send uplink data simultaneously, thus allowing half-duplex operation for the terminals. When performing uplink time slot calculation, the AP preferably takes into account the downlink propagation times from AP to each AT and uplink propagation times from each AT to the AP.

At first the access point (AP) allocates the total available frame periods in near future to terminals (AT) by calculating the amounts of time each terminal will be granted in downlink and uplink. The access point (AP) knows how much transmission capacity each terminal needs, since the access point knows the connection types of the terminals. For obtaining this information for packet connections, the access point can periodically poll the terminals. Also, the terminals can indicate to the access point that they have data waiting to be transmitted. For example, the access point can periodically arrange a time slot for that purpose, during which any terminal having data waiting to be transmitted can send such an indication. After calculating the amounts of time needed by the terminals, the scheduler allocates exact time slots for the reception and transmission times of the terminals using a certain set of rules and trying to fulfill the amounts of time needed by the terminals and the requirements of the rules in an as optimal way as possible. One set of such rules according to an advantageous embodiment of the invention is described in the following. It is specifically noted here that the following is an example only, and other sets of rules for determining the transmission and reception times for the terminals could be used.

Only those terminals who need transmission or reception capacity are considered. Terminals are ordered according to the distance i.e. the time delay of the terminal from the access point. The transmission/reception time slot of the terminal of the first group (group A) which is closest to the access point is here denoted A_1, and that of the one furthest from the access point A_n. Similarly, the transmission/reception time slots of terminals of the second group (group B) are

denoted from B_1 to B_n according to the distance of the terminal from the access point. The distance i.e. the time delay of the terminals from the access point is known by the access point, since during the phase when a new terminal initiates communications with the access point, the access point adjusts the timing of the terminals so that the transmissions of the terminal arrive at the access point at the desired times. Therefore, both the access point and the terminal know the time delay caused by the propagation of the radio signal from the terminal to the access point or vice versa.

The broadcast message directed to terminals of the first group is denoted BM_A in the following, and the broadcast message to terminals of the second group is denoted BM_B.

In the downlink transmission, the access point aims to transmit BM_A in the beginning of the frame and BM_B in the middle of the frame. The position of BM_B within a frame is not very critical. However, it is very advantageous if successive first broadcast messages BM_A are repeated with a period of one frame period, and the second broadcast messages BM_B as well with a period of one frame period, which allows the terminals to adjust exactly to their respective broadcast message timing without having to listen and wait for a broadcast message to occur.

If the same capacity is needed for group A terminals as for group B terminals, the transmissions of the AP are organized as follows:

$$BM_A, B_1, \ldots, B_n, BM_B, A_1, \ldots, A_n \qquad (1)$$

That is, the first broadcast message BM_A is transmitted first, followed by transmissions directed to individual terminals in group B, whereafter the second broadcast message BM_B is transmitted, followed by transmissions directed to individual terminals in group A.

In the case that the terminals in group B need to receive longer than terminals in group A, the transmissions of the AP are organized as follows:

$$BM_A, B_1, \ldots, B_k, BM_B, B_{k+1}, \ldots, B_n, A_1, \ldots, A_n \qquad (2)$$

That is, the first broadcast message BM_A is transmitted first, followed by transmissions directed to individual terminals in group B. The second broadcast

message BM_B is transmitted in or as closely after the middle of the frame as possible, followed first by those transmissions to terminals in group B which did not fit in the frame between the two broadcast messages. The frame is finished by transmissions directed to individual terminals in group A.

In the case that the terminals in group B need to receive for a shorter time than terminals in group A, the transmissions of the AP are organized as follows:

$$BM_A, B_1, \ldots, B_n, A_1, \ldots, A_k, BM_B, A_{k+1}, \ldots, A_n \qquad (3)$$

That is, the first broadcast message BM_A is transmitted first, followed by transmissions directed to individual terminals in group B. After these, transmissions to terminals in group A are started, and the second broadcast message BM_B is transmitted in or as closely after the middle of the frame as possible. The frame is finished by transmissions to those terminals in group A, whose transmissions did not fit in the first half of the frame.

Since the terminals need to be instructed when to receive data, a terminal cannot receive data before it has been instructed about the correct time. Consequently, in the previous schemes, the reception times for at least those terminals of the B group whose reception times are before the BM_B of the current frame, have been specified in the BM_B of the previous frame, and preferably the reception times of the rest (if any) of B terminals as well. The broadcast messages may specify reception and transmission times for a longer time span than one frame.

The previous schemes (1), (2) and (3) have the advantage, that a terminal does not need to receive directly after reception of a broadcast message informing the terminal about its reception time. Without such an arrangement, an idle period may need to be used after a broadcast message, since the interpretation of the contents of a broadcast frame does not happen instantaneously due to the processing time needed to decode a broadcast message, which are typically encoded in various ways in order to enable error correction. However, in the previous schemes (1), (2) and (3) the terminal to which the transmission after a broadcast message is directed is able to receive the transmission, since the broadcast message is directed to terminals of the other group. For example, after BM_A, terminal B_1 is able to receive data at once, since that terminal is not busy decoding BM_A.

For the transmissions, the access point takes into account a guard period, which is required between the reception and transmission periods of a terminal in order to allow the terminal to change between transmission and reception operating modes. When performing the allocation, the access point adjusts the transmission and reception times so that none of the terminals is required to send within the guard period after or before a reception period of the particular terminal.

In the uplink direction, the closest terminal of group A is allowed to send after the guard period after the end BM_A, whereafter transmission periods are granted to other terminals in group A in order of distance, i.e. the second closest terminal next and so on. After the A terminals, transmission periods are granted to terminals in group B similarly in order of distance.

D. FURTHER ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

According to an advantageous embodiment of the invention, a system for providing wireless point-to-multipoint connections is provided. Said system comprises an access point using full-duplex mode and terminals using half-duplex mode. In said system,

- each of a plurality of the terminals has an equipment identifier,
- each of said plurality of the terminals is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on said equipment identifier according to a predefined rule; and
- the access point is arranged to send a first broadcast message to said first group of terminals and a second broadcast message to said second group of terminals, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

In order to realize said functionality of classifying, sending and scheduling, said system preferably comprises means for classifying said terminals in said terminals, means in the access point for sending a first broadcast message and a second broadcast message to a first group of terminals and to a second group of terminals respectively, and means in the access point for scheduling transmission periods of terminals. Said means for classifying, sending and scheduling can advantageously be implemented using processors executing software program elements stored in a memory means in the particular system element.

According to a further advantageous embodiment, in said system the access point is arranged to schedule the transmission period of at least one terminal of said first group to overlap at least partly with the transmission period of said second broadcast message.

According to a still further advantageous embodiment of the invention, an access point of a point-to-multipoint wireless link system is provided. According to the embodiment, the access point is arranged to send a first broadcast message in a frame to a first group of terminals and a second broadcast message in said frame to a second group of terminals, and the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

In order to realize said functionality of sending and scheduling, the access point preferably comprises means for sending a first broadcast message and a second broadcast message to a first group of terminals and to a second group of terminals respectively; and means for scheduling transmission periods of terminals. Said means for sending and scheduling can advantageously be implemented using a processor of the access point executing software program elements stored in a memory means in the access point.

According to another advantageous embodiment of the invention, a terminal of a point-to-multipoint wireless link system is provided, which terminal has an equipment identifier. According to the embodiment, the terminal is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on the equipment identifier according to a predefined rule. In order to realize said functionality of classifying the terminal preferably comprises means for classifying the terminal. Said means for classifying can advantageously be implemented using a processor of the terminal executing software program elements stored in a memory means in the terminal. According to a further advantageous embodiment, the terminal is arranged to perform the classification based on the value of the least significant bit of the identifier.

According to a yet further advantageous embodiment of the invention, a method for providing wireless point-to-multipoint connections between an access point and a plurality of terminals is provided. In the method, the terminals are grouped into a first group and a second group, during a transmission frame, the access point sends a first broadcast message to terminals in the first group and a second broadcast

message to terminals in the second group, and at least one of the terminals of the second group is scheduled to transmit during at least a part of the transmission period of said first broadcast message. In a further advantageous embodiment, in said method at least one of the terminals of the first group is scheduled to transmit during at least a part of the transmission period of said second broadcast message.

E. FURTHER CONSIDERATIONS

The invention has several advantages. For example, the invention allows the elimination of idle time in the uplink direction during broadcast message transmissions in the downlink direction.

The invention has been described in the following as applied in the HIPERACCESS and HIPERLAN systems, but the invention is not limited to application in those systems. The invention can be used in any other PMP radio link systems, where a central station using full-duplex mode communicates with slave stations using half-duplex mode.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. System for providing wireless point-to-multipoint connections having an access point using full-duplex mode and terminals using half-duplex mode, **characterized** in that
- each of a plurality of the terminals has an equipment identifier,
- each of said plurality of the terminals is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on said equipment identifier according to a predefined rule; and
- the access point is arranged to send a first broadcast message to said first group of terminals and a second broadcast message to said second group of terminals, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

2. A system according to claim 1, **characterized** in that
- the access point is arranged to schedule the transmission period of at least one terminal of said first group to overlap at least partly with the transmission period of said second broadcast message.

3. Access point of a point-to-multipoint wireless link system, **characterized** in that
- the access point is arranged to send a first broadcast message in a frame to a first group of terminals and a second broadcast message in said frame to a second group of terminals, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

4. Terminal of a point-to-multipoint wireless link system, which terminal has an equipment identifier, **characterized** in that
the terminal is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on the equipment identifier according to a predefined rule.

5. The terminal according to claim 4, **characterized** in that
the terminal is arranged to perform the classification based on the value of the least significant bit of the identifier.

6. Method for providing wireless point-to-multipoint connections between an access point and a plurality of terminals, **characterized** in that
- the terminals are grouped into a first group and a second group,
- during a transmission frame, the access point sends a first broadcast message to terminals in the first group and a second broadcast message to terminals in the second group, and
- at least one of the terminals of the second group is scheduled to transmit during at least a part of the transmission period of said first broadcast message.

7. The method of claim 6, **characterized** in that
at least one of the terminals of the first group is scheduled to transmit during at least a part of the transmission period of said second broadcast message.

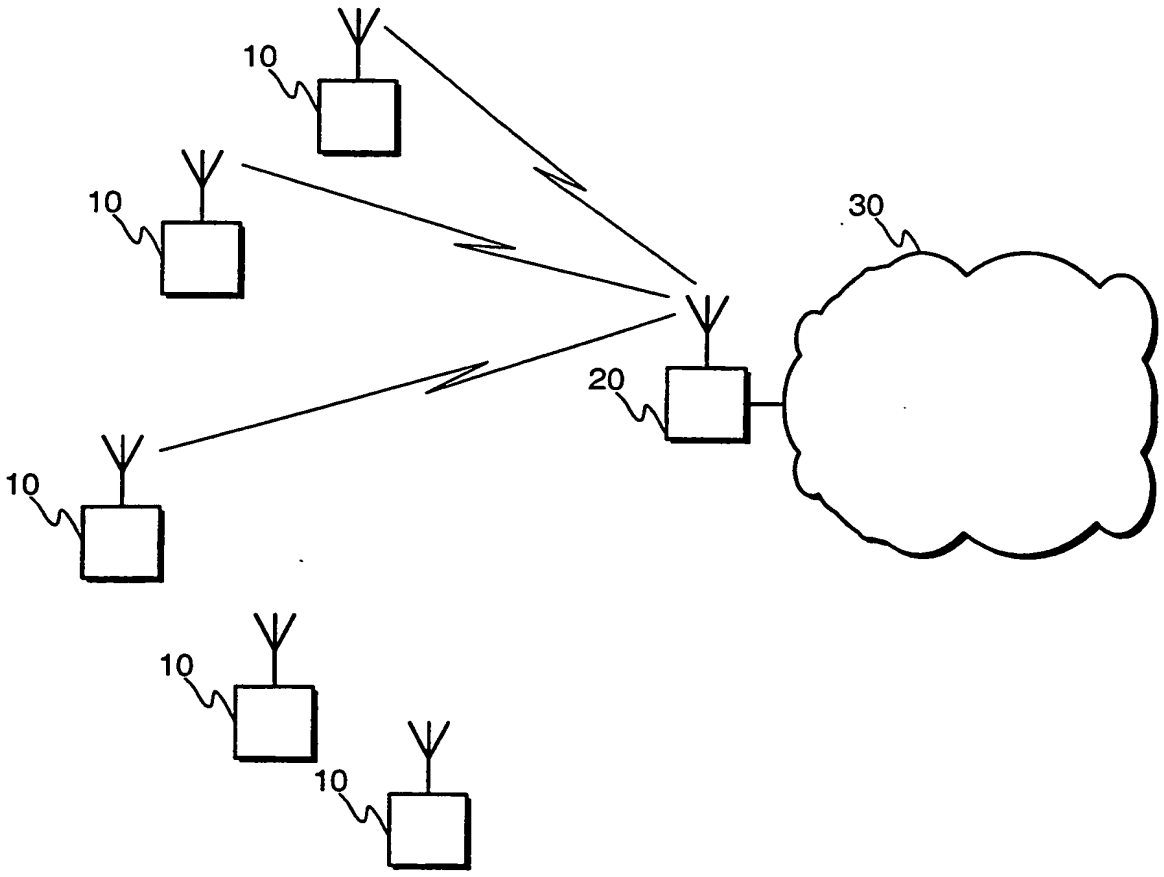


Fig. 1

PRIOR ART

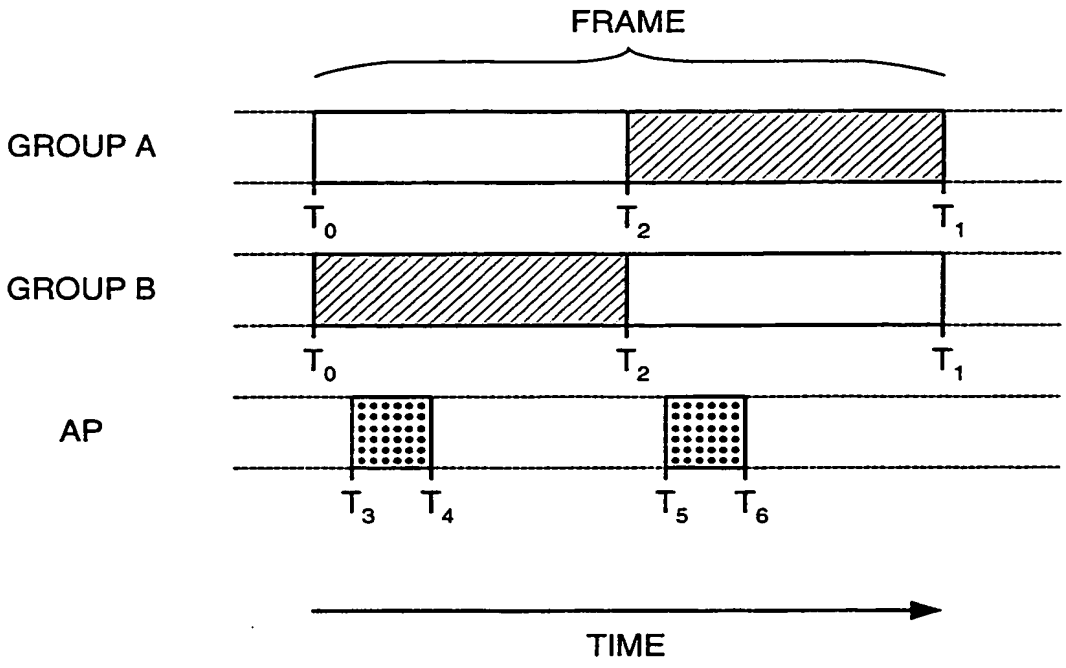


Fig. 2

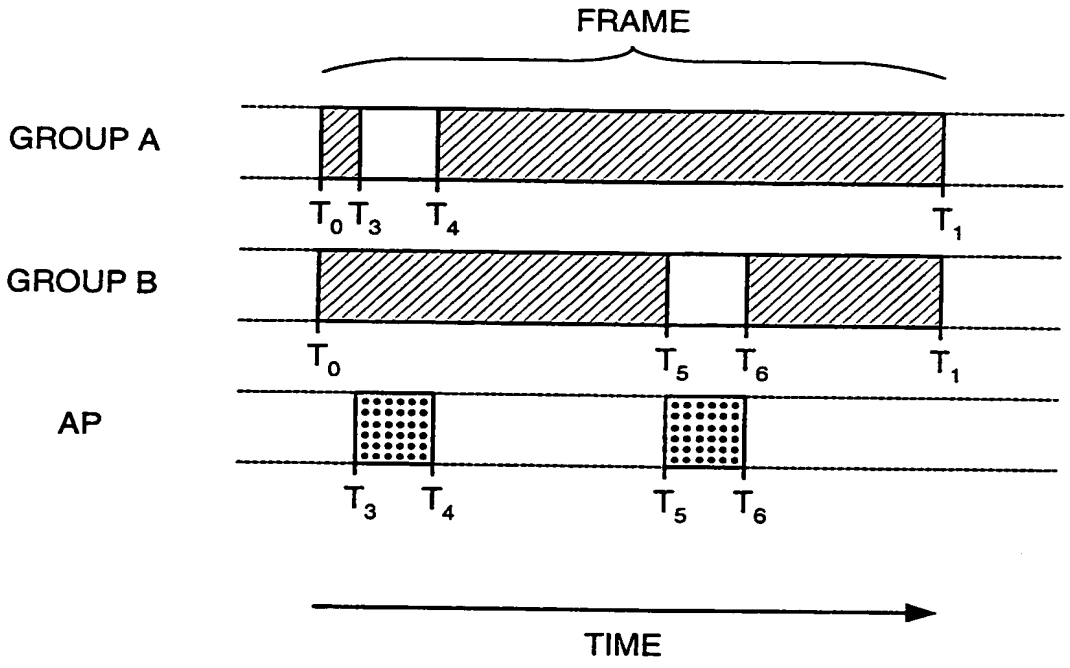


Fig. 3